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Patent Disclosure

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54) Description:	Method for the production of trivalent and tetravalent glasses
71) Patentee:	Wüstenfeld, Aloys, Dr., 7035 Waldenbuch
72) Named as inventor:	Inventor is patent applicant

- 1 -

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Method for the production of tri and tetravalent glasses

The invention concerns a method for the production of tri and tetravalent glasses, which contain nitrides and carbides of the metals of the 4th and 6th transition elements of the periodic table.

Known glasses are the monovalent fluorberyllate glass and the divalent oxidic glasses, as well as borate, silicate, germaniate, phosphate, and arsenate glasses, and more rarely sulfide glasses. The simply composed sodium-calcium glass, which has the composition $\text{Na}_2\text{O} \cdot \text{CaO} \cdot 6\text{SiO}_2$, is the "normal glass". Besides the normal glasses, hundreds of specialty glasses with particular, new properties are obtained by more or less far-reaching changes in the composition. Compared to the monovalent fluorberyllate glass, the oxidic divalent glasses feature increased light refraction and hardness properties.

Of great technical interest is therefore the achievement of an additional increase in these properties by transitioning to trivalent or even tetravalent glasses. This is the task of the present invention.

This task is solved by adding metallic titanium in powder form to the melt of monovalent and divalent glasses, preferably the melts of divalent glasses, which reacts with the gases such as nitrogen, N_2 , carbon monoxide CO , carbon dioxide, and others contained in the melt to form nitrides and carbides. The kinds of reaction products are formed, which are dissolved by the melt. Glass shards can also be ground into powder, and titanium powder and carbon powder, for example lampblack, can be added and melted together, whereby the nitrogen for the nitride formation can be taken from the air.

- 2 -

Apparently, the metallurgic processes occurring between the metal and the glass melt lead to other products than the typical chemical methods for synthesizing titanium nitride and titanium carbide; thus, the addition of the chemically produced components in the glass melts does not lead to the desired result. Rather, it leads to foam formation of fairly coarse bubbles while decomposing the components and forming the trivalent oxide of titanium.

Other metals of the 4th to 6th transition group of the period table can also be used in place of titanium, whereby the metals titanium, niobium, and tantalum are preferred for the production of trivalent, nitrogen-containing glasses, and the metals vanadium, molybdenum, and tungsten are preferred for the production of tetravalent glasses.

Titanium behaves optimally in all cases both for the nitride formation, as well as the carbide formation. Of particular advantage is the presence of the oxides of iron and manganese in the melt, which apparently increase the solubility of the reaction products in the glass melt. Practically all technical glasses are suitable for the synthesis; even the silicate melts of the minerals. The glasses of this invention are mixed glasses of the two classes of divalent and trivalent or of divalent and tetravalent, or of di, tri, and tetravalent glasses, in which the nitrides and carbides of titanium or other metals are present as complex component, in which mostly iron or another metal is contained.

Particularly apparent is the high hardness of the glasses of this invention with which normal glasses can easily be cut. The hardness corresponds to that of hardened metals. Also, the refractive indices are higher than those of divalent glasses.

Of great technical interest is foamed, cellular trivalent and tetravalent glass for seals, insulation, filter media, catalyst supports, and the like. It is formed from melts by an excess of volatile components such as N_2 , CO, and CO_2 .

- 3 -

The mixing ratios of trivalent and tetravalent glasses to divalent glasses can vary over wide ranges; both mixed glasses with a small portion of divalent glasses, as well as mixed glasses with a large portion of divalent glasses can be produced. The solubility among them is seamless.

Example 1

Shards of window glass are pulverized until they up to 55% of it exhibit a particle size below 0.075 m. Five % titanium powder with less than 20 μm are added to it and heated to 875°C at layer thicknesses of the powder of 25 mm and more, whereby the titanium is completely dissolved by the glass melt while taking up nitrogen from the air to form a bronze-colored, mixed glass. This way, a foamed cellular product is obtained, which can be purified by an additional increase in temperature into a bubble-free glass.

Example 2

Five percent titanium powder and 1% lampblack are mixed with glass powder of window glass in a ball mill and heated to 875°C. A product of a dark black color, high sheen, and extraordinary hardness is obtained, with which window glass can be cut. It can also be purified by increased temperature. It is present as a foamed glass without purification and with an excess of soot.

Example 3

Titanium powder and glass powder are mixed at a ratio of 1 : 1 for the production of a platelet of high hardness for metal treatment, and a small, cuboid cast of appropriate dimension is filled with it and heated to 875°C. A hard, bubble-free platelet is obtained, whose hardness can be increased with the addition of lampblack.

All products according to Examples 1 to 3 have to be rendered stress-free in a glass relaxation oven at 500°C.

- 4 -

Patent Claims

1. Method for the production of trivalent and tetravalent glasses, characterized by titanium metal powder being introduced into the glass melt of normal glasses and reacting with the reaction partners nitrogen and/or carbon, preferably in the form of its oxides CO and CO₂, which are present in or added to the melt, into reaction products, which are soluble in the glass melt..
2. Method according to Claim 1, characterized by using the metals of the 4th to 6th transition group of the period table of the elements in place of titanium.
3. Method according to Claims 1 and 2, characterized by using technical glasses in place of normal glasses with more or less far-reaching changes in the composition of the normal glasses, preferably with a content of oxides of iron or manganese, or borate or phosphate-containing glasses.
4. Method according to Claims 1 and 2, characterized by using melts of rocks and minerals of silicates in place of the melts of normal glasses.
5. Method according to Claims 1 to 4, characterized by milling glass shards to powder, mixing them with metal powder, and melting them together.
6. Method according to Claims 1 to 4, characterized by milling glass shards into powder and mixing them with metal and carbon powder, preferably in the form of lampblack, and melting them together.
7. Method according to Claims 1 to 6, characterized by the glass melt being brought to foam by an excess of volatile components.

Gerd and Kathy Renno

From: <JNorq@aol.com>
To: <GBStaple@aol.com>; <gkrenno@cox.net>
Sent: Thursday, February 20, 2003 4:00 PM
Subject: hi!

Dear Betty,

Kathy and I have been communicating back and forth trying to figure out a time when we could BOTH come and see you. I am looking at just after Easter. I could fly into Chicago and then go up to milwaukee to see my Dad.

Meanwhile...I am looking for a couple of pieces of music I thought you might have:

1. Handel's Water Music arranged for organ.
2. Another piece I have always wanted to work on is the Vivaldi concerto for two violins (I think that's what it's called.)

Any chance you can put your hands on those?

Do you think the Handel Water Music (The little trumpet piece) is appropriate for an Easter prelude?

I wish I lived next door to you! It would be so nice to just drop in and benefit from your wisdom and years of experience.

Don't fret if you don't have the pieces I asked about. I'm sure I can find them at Padelson's across from Carnegie Hall.

LOVE,
Janet Norquist, M.M.E.
(Minister of Music, Extraordinaire)

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